"Advanced Technology Program Overview"

Dr. Richard W. (Chuck) Bartholomew
National Institute of Standards and Technology

Dr. Bartholomew has been with the National Institute of Standards and Technology (NIST) for over ten years, the most recent years being with the Advanced Technology Program (ATP). As a program manager in ATP, his interests have focused on developing programs for, and managing projects in, intelligent control sensors and prognostication tools for condition-based maintenance, energy generation, and automotive manufacturing technologies.

Prior to joining ATP, Dr. Bartholomew was a Senior Evaluator with the Energy-Related Inventions Program (a joint program with the Department of Energy's (DOE) Office of Industrial Technologies (OIT)) where he averaged over 150 new technical evaluations and commercial feasibility studies per year for technologies generating energy from fossil, nuclear and renewable energy resources; energy converters such as combustion engines, electric motors, generators and components; instrumentation and electronic components; automotive technologies; and industrial processes such as wood and lumber drying and processing.

Before coming to NIST, Dr. Bartholomew was a professor of mechanical engineering at Michigan State University where he taught courses in thermodynamics, heat transfer, fluid mechanics, and direct energy conversion while developing new courses in numerical methods in heat transfer, fluid mechanics and combustion. His research was focused on understanding and modeling the interaction of turbulent flows with surfaces and included the redesigned of a low speed wind tunnel to study wind tunnel effects on wake measurements in full-sized wind tunnel.

As a graduate and undergraduate student, he developed and improved algorithms for computing chemical equilibrium of reacting gaseous mixtures; performed diagnostics, emission testing, and performance studies on internal combustion engines; designed instrumentation for use in a sodium-cooled nuclear reactor core; held his senior reactor operator's license for a small research reactor; used mass spectrometry to determine high temperature diffusion coefficients for alkali metals in steels and niobium reactor construction materials as well as uranium concentrations in coal used in fossil-fueled power plants; performed experiments in isotope separation, ion implantation techniques, and maintenance of clean room facilities; and performed thermal/stress-strain analyses of heat exchangers and steam generator components for high temperature gas-cooled reactors.

Dr. Bartholomew received his Ph.D. in Mechanical Engineering from the University of Michigan and his master's and bachelor's degrees in nuclear engineering from Rensselaer Polytechnic Institute. He has professional memberships in the American Society of Mechanical Engineers; Society of Automotive Engineers**;** Sigma Xi Scientific Research Society**;** Tau Beta Pi National Engineering Honor Society; and has held membership in the Baltimore/Washington Venture Capital Group member.

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Introduction to ATP

Energy Performance Workshop for the Chemical and Pulp and Paper Industries, 2000-2020

September 1-2, 1998, Hyatt Regency, Cincinnati, Ohio

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National Institute of Standards and Technology
Technology Administration
U.S. Department of Commerce

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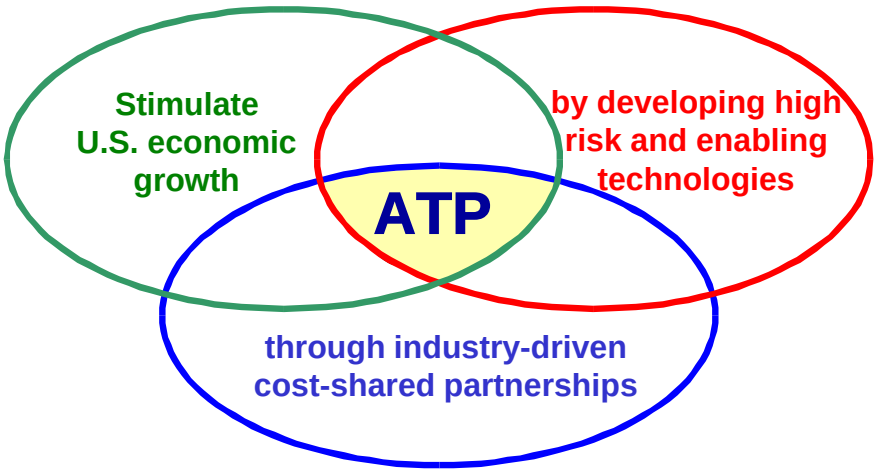
ATP Mission



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The ATP: High Risk - High Payoff

- Substantial technical challenge
- Innovative solutions
- Sound scientific basis
- Credible commercialization plan
- Potential high payoff to the U.S.

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High Risk

- *Technical challenges* displaying significant recognized uncertainty of success
- Success will dramatically change the future *direction of technology* and its market impact
- Risk may be high in developing
  - ✓ single innovations
  - ✓ integrating technologies
  - ✓ or BOTH

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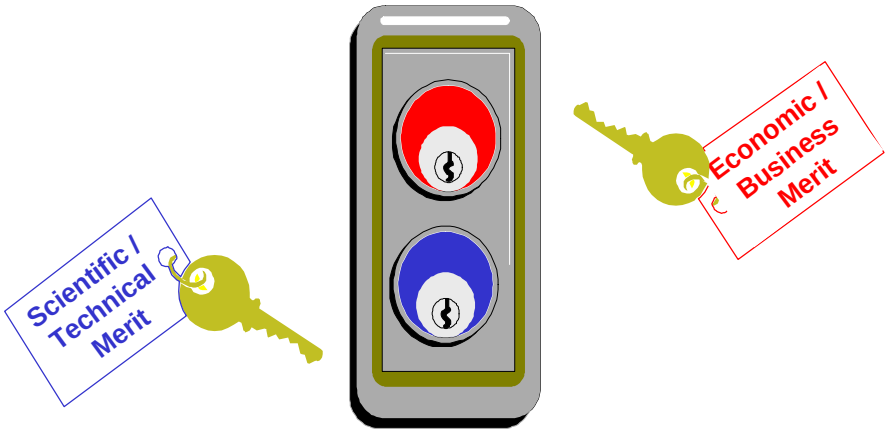
Two Sets of Selection Criteria

ATP AWARDS



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Your "ATP R&D Plan"

Technical Merit Key to Awards

- Quality and innovativeness
- Appropriateness of technical risk and feasibility
- Coherency and vision of R&D plan
- Integrated team approach
- Potential impact on U.S. Technology and knowledge base
- Technical expertise/qualifications

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Why You Also Need A "Business Plan"

- **External**
  - ✓ ATP "Business Plan"
    - ⇒ to get an ATP award
  - ✓ Standard "Business Plan"
    - ⇒ to attract private sector funding
- **Internal** -- to make it happen
  - ✓ Goals / milestones / strategies
  - ✓ Framework for management decisions
  - ✓ Direction for team members

Business Merit Key to Awards

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How ATP Business Plan Is Different

- Earlier Stage -- greater uncertainty
- National Economic Perspective
  vs.
  Company-only Perspective
  - ✓ Private returns to award recipients
  - ✓ "Spillover" returns to others

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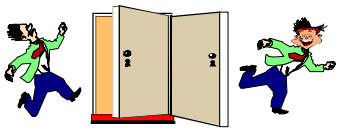
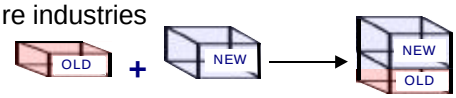
Enabling Technologies - tend to generate "Large Spillovers"

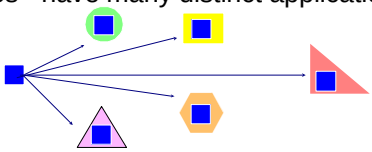
- Pathbreaking technologies - open up new possibilities / revolutionary



- Infrastructural technologies - support R&D, production, and the business of entire industries



- Multi-use technologies - have many distinct applications



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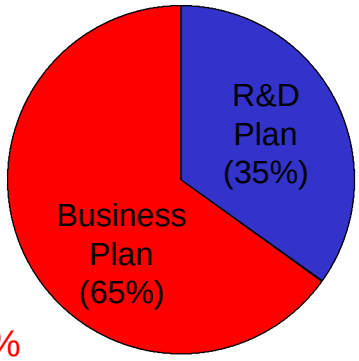
Project Selection Criteria

- Scientific and technical merit - 30%
- Broad-based U.S. economic benefits - 20%
- Commercialization planning - 20%
- Level of commitment and organizational structure - 20%
- Experience and qualifications - 5% & 5%



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Status of ATP

- 3,083 proposals submitted by industry
- 352 projects funded with 842 participants
- $2.32 billion advanced technology development funded
  - ✓ $1.15 billion in ATP share
  - ✓ $1.17 billion in industry cost share
- Small business are thriving
  - ✓ more than 50% of projects led by small businesses
  - ✓ joint ventures have many small business participants
- Universities play significant role
  - ✓ more than 100 different universities involved
  - ✓ more than 250 instances of participation
- Federal laboratories participate

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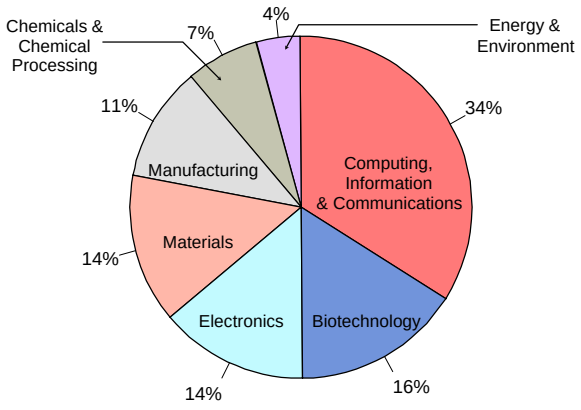
352 ATP Awards By Technology Area

(As a percent of $1,151M ATP support)



Thirty Competitions (1990-1997)

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ATP Benefits

(Projects Funded 1993-1995)

- Economic opportunities
  - ✓ 1,000 different applications identified
  - ✓ 800 commercialization plans prepared
- Acceleration of R&D / time-to-market reduction
  - ✓ 86% ahead in R&D cycle
- Collaboration
  - ✓ assisted 78% of participants achieve ATP project goals.
  - ✓ consider ATP greatly or moderately responsible for 85% of collaborations
- Increased high-risk technology development investment
  - ✓ stimulated investment of ~$200 million (59% increase) in internal funds beyond what industry would have invested without ATP

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Technology Development Accelerated

(28 ATP Projects Funded 1991)

- 96% experienced reduced development cycle time
  - ✓ ranges from 30% to 60%
  - ✓ more than half experienced 50% reduction
- 54% quantified economic value of reduced cycle time
  - ✓ estimates ranged from $1.0 M to several billion dollars
  - ✓ median of $5.5 M
- 86% expect acceleration in technology development to flow through to faster entry into marketplace.
- 86% believed cycle-time improvements achieved in ATP project carried over to non-ATP projects

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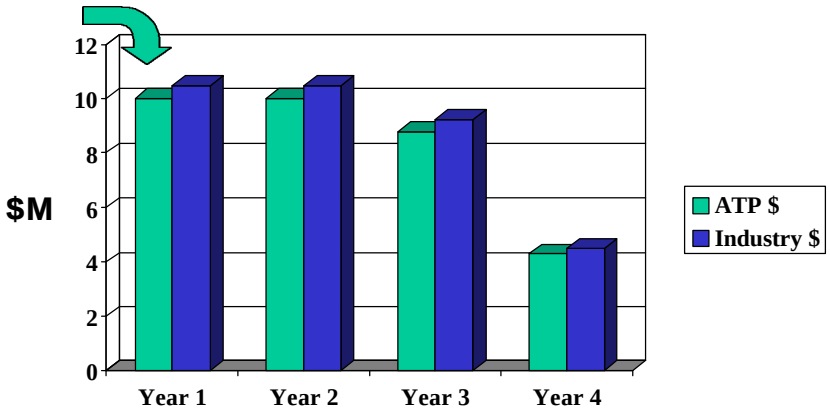
Solicitation Math

Solicitation

288 project average spending



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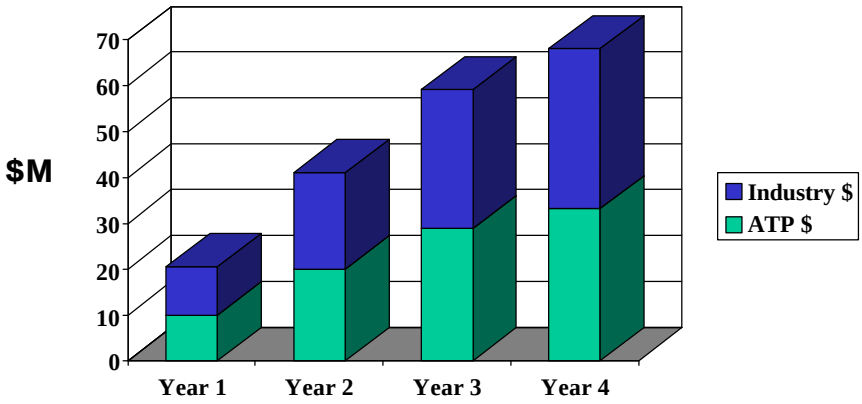
Solicitation Math



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Contact Information

To Browse ATP Information

World Wide Web: http://www.atp.nist.gov

To Get on the ATP Mailing List

CONTACT

Call toll-free:	800-ATP-FUND (800-287-3863)
Fax your name and address to:	(301) 926-9524
Send an e-mail message to:	atp@nist.gov

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Proposal Preparation

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How to Get Started

Start with the big "market-pull" questions and derive plans

Problem Definition

- What problem or opportunity do you wish to address?
- How important is it? Why? Who will benefit?

Competitive Analysis

- What is your proposed solution?
- What are competing solutions? Providers?
- How will yours be better?

Goals and Strategies

- What are your relevant strengths, weaknesses, special capabilities, and resources?
- What are possible goals and strategies? What are yours?
  - Business goals and strategies
  - Technical goals and strategies

→ **Barriers** → **Detailed Plans**

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"Reverse Engineering" of Proposals

- Establish commercial benefits and strategy
- Identify technical barriers to realizing benefits
- Relate technical barriers to specific R&D objectives
- Plan research to eliminate barriers
  - ✓ high risk
  - ✓ coherent
  - ✓ innovative
  - ✓ integrated
- Present details of R&D plan

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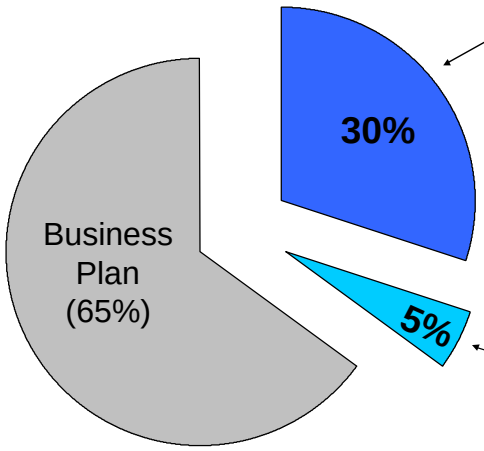
What Your R&D Plan Should Cover



Scientific and Technical Merit

- Quality / innovativeness
- Technical risk & feasibility
- Coherency & vision
- Team approach
- Impact on technology base

Experience and Qualifications

- Technical expertise
- Qualifications

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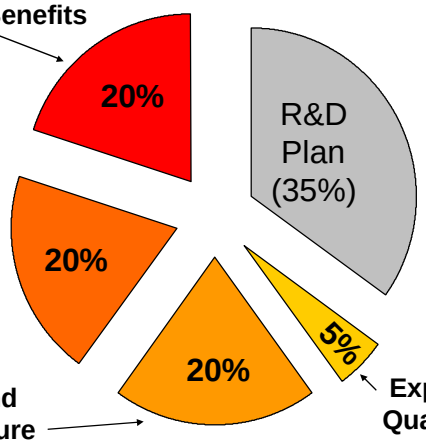
What Your Business Plan Should Cover

Broad-based U.S. Economic Benefits

- Timeliness
- Need for ATP to achieve goals
- Spillover benefits

Commercialization Plans

- Evidence will pursue commercialization
- Identifies applications
- Technology diffusion



Commitment Level and Organizational Structure

- Best resources committed (people, equipment …)
- For JV's, vertical/horizontal integration
- For JV's, extent of small business participation

Experience & Qualifications

- Business expertise
- Qualifications

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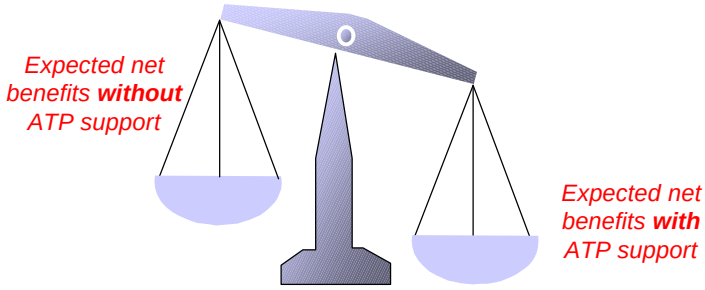
Why ATP Support?



✓ Why do you need it?
✓ What difference will it make?
✓ Why is it justified?

Burden of proof is particularly heavy on proposers with substantial resources

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Quality and Innovativeness

- Clear, quantitative technical objectives
- Knowledge of state of the art
  - ✓ research
  - ✓ engineering
  - ✓ manufacturing
  - ✓ domestic and foreign competition
- Uniqueness with respect to current practice
- Potential for broad-based scientific and engineering advances
- Cost-effectiveness of technical program

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ATP Eligibility

- **Single Proposers** (No more than 3 years)
  - ✓ Up to $2M total NIST funds
  - ✓ NIST pays only direct costs
  - ✓ Large companies cost share at least 60% of project cost (**NEW, 98**)
  - ✓ No direct funding to
    - universities
    - governmental laboratories
    - non-profit independent research organizations
- **Joint Ventures** (No more than 5 years)
  - ✓ No limit on award amount
  - ✓ NIST share less than 50%
  - ✓ Must involve two or more for-profit companies
    - both doing research
    - both contributing to cost share
  - ✓ JV administrator may be industry or independent research organization

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Foreign Company Participation

- U.S.-incorporated, foreign-owned companies eligible
- Project must result in economic benefits to the U.S.
  - ✓ R&D and manufacturing in the U.S.
  - ✓ Increase U.S. employment
  - ✓ Promote U.S. supplier infrastructure
  - ✓ All companies also must meet these requirements
- Country of origin must provide local investment and grant opportunities to U.S.-owned companies
  - ✓ Comparable to any other company in that country
  - ✓ Protects intellectual property rights
- PL 102-245: award suspension if criteria no longer satisfied

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Technical Risk and Feasibility

- Go beyond current state of the art
- Key balances
  - ✓ technical risks
  - ✓ feasibility
  - ✓ payoffs
- Establish credibility of R&D plan
- Link technical barriers and risk with R&D approaches
- Correlate objectives, plans, and funding

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Business Factors You Need To Address

- Potential market opportunities
  - ✓ targeted areas
  - ✓ priorities
  - ✓ commercialization strategies
- Technology diffusion
- Protection of intellectual property
- Business milestone progress chart (recommended)

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Intellectual Property Provisions

- Companies incorporated in the U.S. keep intellectual property rights
- Companies can license
- Government reserves the right to royalty-free non-exclusive license for government use
  - ✓ Non-disclosure (trade secrets protected)
  - ✓ Government rights rarely invoked
- Universities and non-profit research organizations
  - ✓ May receive royalties
  - ✓ Cannot own title to intellectual property

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Technology Diffusion & Intellectual Property Protection

- How will widespread use of the technology occur? For example:
  - ✓ sales
  - ✓ licensing
  - ✓ alliances
  - ✓ user groups
  - ✓ publications / presentations
  - ✓ other
- How will commercialization incentives and benefits to the U.S. be preserved?
  - ✓ patents
  - ✓ copyrights
  - ✓ trade secrets
  - ✓ speed to market
  - ✓ other

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Common Proposal Weaknesses

- Lacks adequate technical detail
  - ✓ no definition of research tasks
  - ✓ only identifies research areas
- No evidence of innovation or uniqueness
- Incoherent technical plan
  - ✓ no linkup with scientific objectives
  - ✓ simple restatement of goals
  - ✓ no description of "how" for key tasks
- Inappropriate risk
  - ✓ not technically challenging
  - ✓ specific product development
  - ✓ basic research
- Inadequate knowledge of state of the art

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Plans for Commercialization - Tips

- ***Don't*** deny or side-step need for a plan, as indicated by
  - "We must first establish technical specifications; then, we can plan how to get to market."
  - "There's no need for commercialization planning because the technology is so good it will sell itself."
  - "We will turn the results of R&D over to our company's marketing / product development people and they will take it from there."
- ***Do***:
  - ✓ Begin planning for commercialization at the outset.
  - ✓ Understand that a fantastic technology may capture the imagination but not necessarily the market.
  - ✓ Involve marketing / product development / production people from the beginning.

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Broad-based Economic Benefits -- Tips

- ***Don't*** make empty, unsupported claims such as
  - ~~"This proposed project addresses a large, important industry, therefore benefits will be huge."~~
  - ~~"This technology will have numerous [unspecified] applications."~~

- ***Do***:
  - ✓ Explain how the technology will impact the economy
  - ✓ Be specific
  - ✓ Give supporting evidence

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ATP R&D Alliance Network

http://www.atp.nist.gov/alliance

- Promotes formation of ATP Joint Ventures
- Provides sense of resources required for successful ATP Joint Venture
- Collaboration Bulletin Board, an electronic forum on which potential proposers can seek partners